

# **Strategic Uses of Mobile Phones in the BoP: Some Examples in Latin American Countries**

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### **Strategic Uses of Mobile Phones in the BoP: Some Examples in Latin American Countries**

**Abstract:** This paper studies the determinants of the use of different strategies by mobile users for reducing their spending. This empirical exercise is done with a special survey focused in low income people from developing countries such as Argentina, Brazil, Colombia, Mexico, and Peru. Our methodology is the following. First, we evaluate the determinants of use of each strategy by means of a probabilistic model and we find that education level and age are important determinants of the use of alternatives. Second, we use a Poisson regression model to study the number of strategies used. Although our findings differ among countries, the use of more than one strategy is common in the sample.

**Keywords:** Mobile Phones, Poverty, Count Data. JEL Classification: D12, C35, L86

### **Usos estratégicos de los teléfonos celulares en el “Bottom of the Pyramid” (BoP): Algunos ejemplos para América Latina**

**Resumen:** El objetivo del trabajo es analizar el uso de un conjunto de estrategias para minimizar el gasto en teléfono móvil en una encuesta de teléfono móvil para personas de bajos ingresos en Argentina, Brasil, Colombia, México y Perú. La metodología empleada incluye dos etapas; primero, se evalúa cuáles son los determinantes del uso de cada estrategia mediante un modelo probabilístico y se encuentra que la edad y el nivel de escolaridad influyen positivamente en la probabilidad de usar las alternativas; segundo, se utiliza un modelo de Poisson para evaluar el número de estrategias utilizadas. Aunque los resultados difieren entre países, es común encontrar que los usuarios tienden a utilizar varias estrategias.

**Palabras clave:** Teléfono móvil, pobreza, modelos de conteo. Clasificación JEL : D12, C35, L86

### **Utilisations stratégiques des téléphones portables dans le Bottom of the Pyramid (BoP) : Quelques exemples pour les pays d'Amérique latine**

**Résumé:** L'objectif de cet article est d'analyser l'utilisation d'un ensemble de stratégies visant diminuer les dépenses dans l'utilisation des téléphones portables, à partir d'un sondage fait chez les personnes à bas revenu en Argentine, Brésil, Colombie, Mexique et Pérou. La méthodologie employée considère deux étapes : Premièrement, il s'agit de déterminer les causes de l'utilisation de chaque stratégie à travers un modèle probabiliste, ce qui nous a permis de conclure que l'âge et le niveau de scolarité des personnes ont un impact positif sur la probabilité d'utiliser les stratégies. Deuxièmement, on utilise un modèle Poisson pour évaluer le nombre de stratégies utilisées. Même si les résultats diffèrent entre les pays considérés, nous trouvons que les usagers des portables ont une tendance à utiliser plusieurs stratégies.

**Mots clé:** Téléphonie mobile, pauvreté, modèles de comptage. Classification JEL : D12, C35, L86

# Strategic Uses of Mobile Phones in the BoP: Some Examples in Latin American Countries

Luis Fernando Gamboa\*

—Introduction. —I. Theoretical Background. —II. The Sector of Telecommunications. —III. Empirical Results. —Conclusions.— References.

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## Introduction

This paper studies the determinants of the use of different strategies used by mobile-users for reducing their spending in a sample of people from the Bottom of the Pyramid (BoP) in some Latin American countries. The importance of mobile in actual societies is widely recognized for its impact on business, among other factors. The diffusion of mobile communication technology (e.g. wireless internet, mobile phone, among others) has been enormous around the world during the last years. In particular, mobile phone has grown as a consequence of several reasons such as the strengthening of competition among operators (reduction in prices), the introduction of the modality of prepayment and the necessity of this type of devices in many jobs and social relations. Several authors, argued that mobile let the people to explore (e.g. make new friends, create new communities) and to enhance

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(e.g. keep in touch with family, friends and people of different cities) as well as to isolate or get status (e.g. disconnect from others or to have the most fashioned devices). These particularities make mobile an interesting example of economic behaviour. (See, Gergen, 2002 and Sugiyama and Katz, 2003). Mobile also let the people to deregulate time and space controls and to transfer from a location-based social system to a person-based system in which people benefit from permanent availability. Furthermore, many of their additional services have encouraged the development of several things as short message services (SMS), *ringtones* and Internet. However, some of them require a minimum level of digital literacy and are limited to special devices with additional costs in many cases. It explains the differences in penetration levels between developed and developing countries.

In Latin American countries, it is common to find a considerable portion of households without access to mobile at home while others have more than one mobile (see Barrantes y Galperin, 2008; Mariscal, 2007; Gamboa and Otero, 2009) for details on access and usage to mobile in Latin America). Latin America is characterized by low schooling and income levels. Consequently, people have to look for a set of strategies in order to minimize their living cost. In communications, mobile technology let the people to use some functionalities to decrease the cost of mobile use. Some characteristics such as people living in rural areas, low levels of literacy and bottlenecks in infrastructure, makes mobile telephony a good way for implementing public programs and it encourages digital literacy as a necessary condition for the use of things such as: M-governmet, M-commerce y M-banking.

The purpose of the paper is to study the determinants of the use of short run strategies in a sample of people from the bottom o0f the pyramid (BoP) for five Latin American countries: Argentina, Brazil, Colombia, Mexico and Peru. Short run strategies are adopted when the choice of buying the mobile is already done (Zainudeen *et al.*, 2006). In order to do it, we use a two step strategy. First, we estimate a probabilistic model for establishing the impact of socioeconomic variables (gender, age, educative level, type of contract among others) on the use of each strategy. Due to survey design, each respondent could answer more than one strategy to the

question. This fact prevents us to use other alternatives under the random utility models.

In a second step, we are interested in evaluating the determinants of using more strategies. The survey does not ask about the intensity of use of each strategy but the use each one. Then, we estimate count data models for studying what determines the number of strategies used by the users.

The choice of these countries is a consequence of the data availability in the project “Mobile Opportunities: Poverty and Telephony Access in Latin America and the Caribbean” carry out by DIRSI (*Dialogo Regional sobre la sociedad de la Información*) during 2007 was focused on the patterns of access and usage of mobile and internet technology among low income households in these countries. It is important to say that, the survey is not representative of the population in each country and it implies that there is no enough evidence for formulating policy recommendations from the results. Second, survey is not available for high income or developed countries and this fact limits the possibility of making comparisons with this kind of users.

This paper is an important step in the knowledge of the patterns of use of mobile and the minimization strategies used by people in developing countries from Latin American. To the best of our knowledge, there are no recent works about the strategies employed by users in order to minimize the cost of use of mobile. The paper provides new information about these strategies among low income people, and it is also a good input for public policy in communications. Donner (2008) summarizes the recent literature on mobile use in developing world but as he shows, most of the papers are done for African and Asian countries. Ureta (2008) studies the effect of mobile on the spatial mobility among low income families for a sample of people in Chile. Rouvinen (2006) analyzes the diffusion pattern in developing countries and he includes some Latin American cases. As it can be seen, there are no recent works about Latin American countries as we study in this paper.

The paper is organized as follows: section 1 presents a brief summary of the literature on the digital divide and the patterns of use of mobile in developing countries. Section 2 makes a short description of the sector in

the selected countries. Section 3 includes the data description, methodology and results.

## I. Theoretical background

Penetration of mobile telephony has been slower in the case of developing countries where a large majority of the population still has limited access to communications. It gives place to an extensive literature known as Digital Divide. Hargittai (2003) says that digital divide is a gap between those who have access to digital technologies and those who do not. Some of their components are the access and usage of mobile, Internet and Computers. These technologies have their own advantages for those who know how to exploit them, but it widens the gap with respect to people without it. As it was mentioned before, mobile facilities let the users to reduce cost and to benefit from business opportunities. Gutierrez and Gamboa (2008) and Barrantes (2008) make two different approximations to the digital divide in Latin America giving some priority to the importance of the use of mobile among low income urban people. One important aspect that emerges from these studies is the impact of mobile on the society and the actual importance of mobile for being in contact with clients, friends, parents among others.

In addition, mobile has been expensive during the last decade in Latin America and it generates a set of strategies that people use in order to afford the service and to reduce their impact on their basket. In many studies, the term 'affordability' is used as a synonym of 'person's financial capacity'. In economic analysis, people choose among their alternatives, but in some cases this choice is not possible as a consequence of the availability of the good or service. Barrantes and Galperin (2008) find that affordability is the most important barrier to extending the use of mobile and their added-value services in some Latin American countries. Furthermore, Mobile communications are not a luxury during these days and the study of poverty tends to look at sufficiency of overall income to meet overall needs, rather than at affordability of meeting specific needs. Milne (2006) distinguishes two levels of affordability (or rather its lack), determined by two effects: the 'barrier' effect, which prevents people from owning a phone, or from using shared access phones other than in emergencies and

the 'inhibitor' effect, which discourages people from making as many calls as they need to even when they own or have access to a phone.

The 'inhibitor' effect implies that users have to be rational in the use of mobile and they have to seek for the best use of it. The question is what kind of strategies are utilized by poor people in order to get access to the mobile telephony? It is well known that aspects such as access to credit and low earnings are two important barriers to enter into the market for those who want to make mobile calls.

In many cases, poor people do not have enough money for their basic needs (food, health, education, and rent) and they have to optimize their limited income. Although there is a consensus about their importance for the standard of living, technological change has created a new set of basic needs. Things as Internet, mobile communication and entertainment are considered necessary for living, for getting a job, for being in contact among others (their relatives, workmates, clients and competitors). Today, many things require the use of some kind of information and communication technologies, ICTs. Consequently, they sort their spending in order to get access to most of them. Some authors show that mobile is a necessity for everyone and poor people are not the exception, (Frost and Sullivan, 2005; Bjärhov and Weidman, 2007).

There are many works that assess the use of any kind of strategies the people use for reducing the cost of use of mobile in several countries. Some of them are: Zainudeen *et al.* (2006) for the case of Asia; Gamboa and Gutierrez(2008), Ramirez and De Angoitia (2008) and Frost and Sullivan (2005) for Latin American countries; Donner (2008b), Gamos (2003), Milne (2006) and Dymond and Oestmann (2003) for Africa.

As Zainudeen *et al.* (2006) describe, there are short and long run strategies depending on the time in which the choice is done. Long run strategies are those in which people choose the type of contract and the kind of mobile device. In the short run, people have to decide the cheapest way for communicating given that they have the mobile already.

Among short run strategies we have 'beeping', the use of mobile phone only for receiving calls or during off peak hours, the use of SMS and the use of mobile rented. Beeping involves calling a number and hanging up

before the mobile's owner to whom is directed the call answers. Donner (2008b) says there are three types of beeping: the first is used waiting for the return of the call and in consequence avoids the cost. The second implies a previous code with a specific meaning between the sender and the receiver and the last is a way to being in touch with their relatives. SMS does not require previous codes and it can be used for sending or receiving information when the receiver cannot answer (during meetings, classes, and inclusive for cheating in exams). Bhagat (2007) says that its low cost is an attractive for using it.

Beeping and SMS are also used when it is not needed an immediate answer. In some cases, both are used for translating the cost to the user who returns the call. Gamos (2003) finds that among 45 percent of the mobiles that received a beep, 34 percent return the call. Other strategies as using the mobile for receiving calls or during off-peak hours show that people often have the phone for being in contact with the people who are looking for them. In Colombia, and probably in some other developing countries, the use of mobile rented in the streets is an additional way to avoid price differentials among prepaid and postpaid, and off-net vs. on-net calls. Gamboa and Gutierrez (2008) find that the people in the modality of prepayment and users whose mobile is in the largest market share firm are more frequent user of this alternative. Chakraborty (2004) finds a similar activity in Bangladesh.

One important determinant of the pattern of consumption among people from low income ranges is the volatility of their income which limits their capability of being more rationale in acquiring products with the lower price per unit. Although it seems surprising, demand for telecom services in most developing countries has been shown to be very important for low-income earners (See GSM Latin America, 2006; Gutierrez and Gamboa, 2007). Some authors estimate the proportion of mobile communications expenses to be about 10 percent of their income. (See Intelecon, 2005; Gillwald, 2005; Souter *et al.*, 2005).

Gamboa and Gutierrez (2008) and Ramirez and De Angoitia (2008) describe this behavior for some Colombian and Mexican cities, respectively. They found that it is very common the use of alternatives for minimizing

their spending. The work of Gamboa and Gutierrez (2008) is focused in the resale of minutes in the streets and the study of Ramirez and De Angoitia (2008) summarizes the long and short run strategies. They find that low income people do not use SMS and also prefer to have the phone only for receiving calls, as in the case of other regions (Africa and Asia). Both studies are done using the same database that we used here.

## II. The Sector of telecommunications

Latin America has grown faster in the last decade than in the eighties. In general terms, its standard of living is better because of many aspects as the reduction in poverty levels, the increase in the public services coverage, the economic growth, and the increase in the educative levels of their population. In 2007, poverty and indigence have diminished compared to the previous years. Countries as Mexico, Argentina and Brazil have high per capita income relative to the region and the lowest levels of inequality. In terms of welfare indexes, Argentina and Mexico are better in the Human development rank with respect to Peru and Colombia. Some of the causes of this latent situation are the percentage of the people living in rural areas and the low level of economic growth of these economies.

Table 1. *Social and Telecommunication indicators*

	Argentina	Brazil	Colombia	Mexico	Peru
Poverty incidence 2006 (%) / <sup>a</sup>	21,0	33,3	46,8	31,7	44,5
Per cápita income 2006 (US) / <sup>b</sup>	5 476	5 641	2 945	7 755	3 286
GINI / <sup>c</sup>	52,8	58	58,6	49,5	54,6
Human Develop. Index (rank)	38	70	75	52	87
% Urban Population / <sup>b</sup>	90	85	73	76	73
GDP growth CAGR (03-06) / <sup>b</sup>	8%	3%	3,5%	2%	4,8%
Mobile penetration 2006 / <sup>b</sup>	80,5	53	64,3	52,6	30,9
Fixed penetration 2006 / <sup>b</sup>	24,2	20,5	17,0	18,3	8,5

b. ITU and World Development Indicators c/ PNUD 2006 Data for 2003. CAGR: Composed average growth rate.

Source: a. CEPAL, 2007.

On the other side, the urban population has increased in almost all the Latin American countries. In our survey, most of the people come from two or three major cities (Brazil, Argentina and Mexico). Social indicators in these cities are characterized by higher coverage levels in aspects such as education and public services, but it also has generated differences with respect to rural population. Many of the people who live in the rural areas have not access to ICTs as Internet and cellular phones. Most of the ICT growth in Latin-American countries has been in the high income groups.

Table 2. *Summary statistics in selected countries*

	Argentina	Brazil	Colombia	Mexico	Peru
Socioeconomic					
% Female	50,4	61,1	68,1	72,6	60,7
Age (mean)	34,8	36,7	38,1	36,7	37,1
Access and Usage					
% Users	70	53	89	37	60
% Prepaid	74	96	90	92	96
Calls made (median)	6,7	6,6	11,1	7,1	7,3
SMS sent (median)	33,3	8,1	8,1	25,9	8,7
Strategies (% of owners)					
Beeping	15,7	32,2	43,5	24,5	47,1
off-peak calls	17,2	29,2	28,0	27,2	40,6
phone receiving	33,3	49,9	56,7	57,0	51,0
SMS	69,9	36,0	44,0	52,0	44,0
Total Surveys	1400	1000	800	1000	1312
Total owners	849	424	492	298	465

Source: DIRSI Survey.

The industrial organization of the telecommunications sector is similar to the other developing countries. Competition is one of the factors that has fostered the growth of mobile sector because of its promoted diffusion and encourage innovation. Valleti (2003) and Gruber (2005) provide evidence

in favor of the small number of firms in a mobile market and in some cases it is a result of the regulatory environment. In Latin America today is observed a duopoly between the Spanish firm Telefonica and the Mexican firm America Movil from Grupo Carso that operate in more than twenty seven countries. This result comes from a process of consolidation after some acquisitions and fusions over the past ten years. The process of Telefonica is based on the acquisition of Bellsouth operations and America Movil has been focused in local telephone companies. Other companies such as Millicom have a small market share and their customers are focused among low-income people.

During the nineties, the priority among operators was local and long-distance communications but technological advances let the mobile to bring some new services than increased their importance in their business departments.

*Table 3. Mobile Firms in Selected Countries*

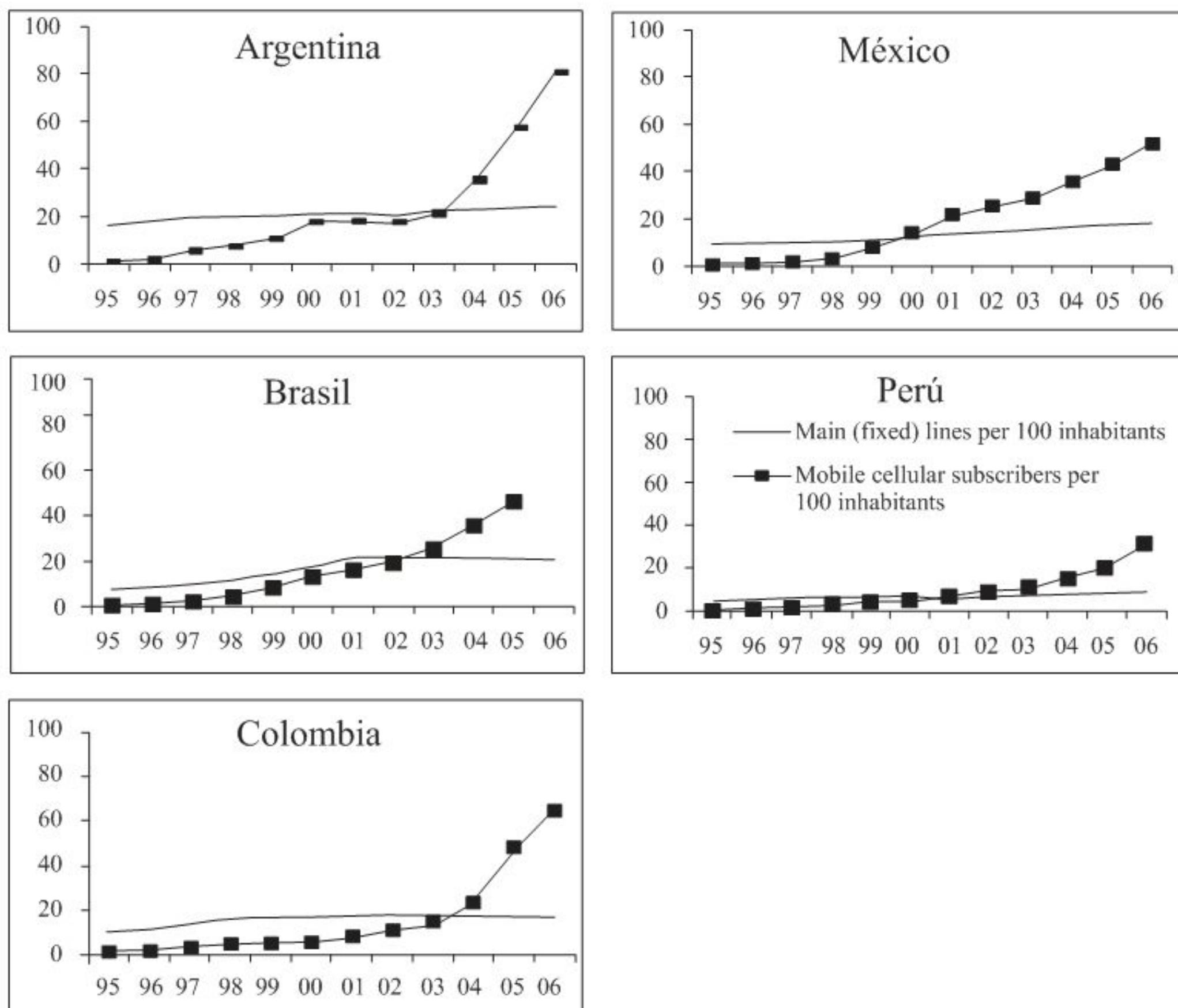
Countries	1995-2000	No.	200-2005	No.	2006-2009	No.
Argentina	Bellsouth, Telefónica, France Telecom, Tim, Agea/Clarin	5	Telefónica, América Móvil, TIM, Nextel	4	Telefónica, América Móvil, TIM, Nextel	4
Brazil	Portugal Tel., Telefónica, British Tel. TIM, Bellsouth, Telia, SK Tel., NTT, Telesystems, DDI	10	Telefónica, Portugal Tel., TIM, America Móvil, Brasil Telecom, Telemig, Oi	7	Portugal Tel., Telefónica, America Movil, Telecom Italia, Oi, Algar, Sercomtel	7
Colombia	Millicom, Bell Canada, Cable & Wireless, Telefónica, AT&T	5	America Movil, Telefónica, OLA	3	America Movil, Telefónica and Millicom (TIGO)	3
Perú	Telefónica, TIM	2	Nextel, Telefónica, América Móvil	3	Nextel, Telefónica, América Móvil	3

Source: Rozas (2005) and Regulators.

These operators have different brand names in Latin American countries. Telefonica uses Movistar in all but Brazil where the brand name is Vivo. On the other hand, America Movil uses the following brands: Comcel, Telcel and Claro in Colombia, Mexico and Brazil, respectively.

After a period of competition between mobile and local operators, the penetration levels changed dramatically in Latin American countries. In

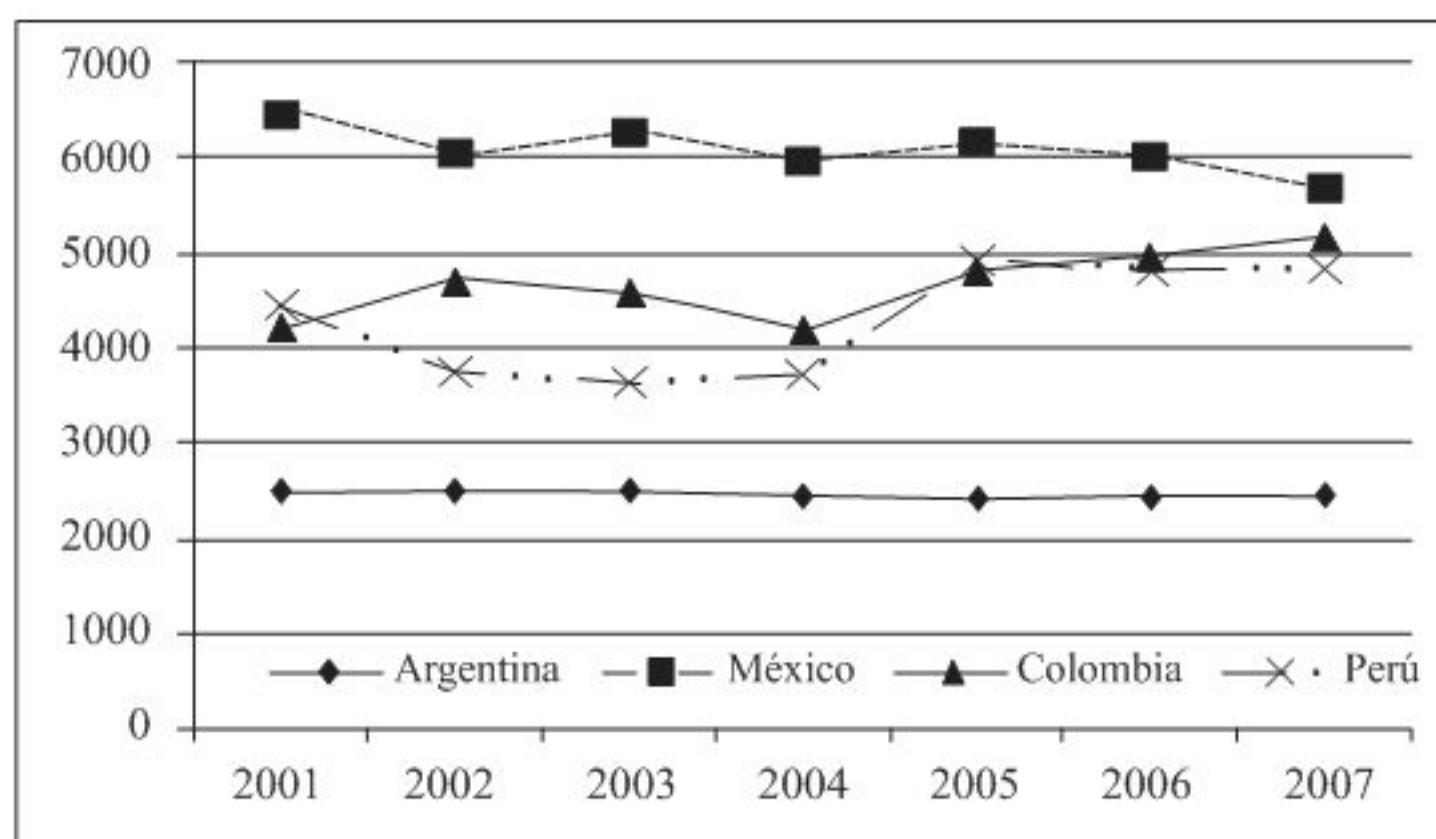
2003, almost all the selected countries have a higher penetration in mobile than in fixed lines, which induced the local operators to increase other segments as broadband and data services. These penetration levels are higher than expected and it also reflects the intensity of competition. As it can be seen, between 2000 and 2003 the mobile penetration was higher than fixed lines in selected countries. However, it is important to note that in Peru this behaviour is not as notorious as in the others. It is also shown that the mobile growth was faster after the introduction of the modality of prepayment and the strengthening of the competition.



Source: International Telecommunications Union 2008

Figure 1. *Penetration of telecommunications by country*

At the same time, concentration levels are very different in these countries when they are measured by the Herfindahl-Hirshman Index (HHI). The HHI is defined as the sum of the squares of the market shares of all firms in a mobile industry. The higher the concentration index, the higher the industry concentration. In 2006, this index ranges from 6148 in Mexico to 2388 in Brazil. Colombia and Peru have indices between 4700 and 4900. Argentina has a similar situation to Brazil with an index of 3232. However, the case of Brazil is particular due to specific conditions in the regulatory scheme which split the country in zones. During this decade, Colombia and Peru exhibit an increasing trend in market concentration since 2004. (see figure 2). At the end of 2007, there were two big groups in Latin America: America Movil (Mexico) and Telefonica (Spain).



Source: operators. Brazil is not shown due to market segmentation.

Figure 2. *Market concentration by HHI.*

In terms of modality of contracts, people in Latin American countries usually have prepaid phones due to several reasons as lower cost and control of spending, (for details see Gamboa and Otero, 2009). In terms of market share, the modality of prepayment has a market share above the 80% in the sample. At the end of 2007, these levels are 80,7% / 84,4% / 88,9% / 90,2% and 92,2% in Brazil, Colombia, Peru, Argentina and Mexico respectively. Here, it is important to note that penetration levels are measured by the number of subscriptions but not the number of users because of the fact that any user can have more than one subscription. As it can be seen,

almost all the population have access to mobile communications in Latin America but its prices are still high with respect to acquisitive levels in many households. The exponential growth of mobile in Latin American countries has only been studied recently (Mariscal and Rivera, 2006; Frost and Sullivan, 2006), but their importance on the familiar budgets has not received similar attention. The current level of mobile penetration in these countries is higher than fixed lines and it is expected to continue growing. Among other factors, the modality of prepayment and the calling party pays, system encourage some of this growth. In particular, the calling party pays system let the people to elaborate strategies in order to reduce their communication cost as the use of beeping, because in this case who receive the call knows who is calling.

### III. Empirical results

We use the data gathered in the study “Mobile Opportunities: Poverty and Access to telephony in Latin American and the Caribbean” carried out by DIRSI. This study was made in Argentina, Brazil, Colombia, Jamaica, Mexico, Peru, and Trinidad and Tobago. The survey was designed for all these countries and it generate most than 7000 observations. However, for comparability and access to data we do not include Jamaica and Trinidad and Tobago in our estimation. Consequently, our final sample is 5512 observations.

As we mentioned before, our purpose is assessing the determinants of the use of any strategy of minimization of mobile spending.<sup>1</sup> We use a Logit model in which the dependent variable is whether the person uses the alternative or not. Then, we have one model for each alternative. Among the explanatory variables we include age, gender, schooling, income, type of contract and the city where he/she lives. This methodology helps us to increase the knowledge of the different strategies used by the mobile-users and to determine if each strategy is used by the same type of person.

In a second step, we evaluate the quantity of strategies used among those who use mobile phone in the survey. This part let us to know if the

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<sup>1</sup> The survey let the people to answer as many option as they use which prevent us to make a ranking for each person and establishing a preference ordering. As a result we have users that choose more than one strategy of minimization.

use of strategies is intensive and who uses more strategies. In the survey, it is not possible to know the intensity of use of each strategy but the number of strategies used. Due to the number of strategies is a discrete and non-negative variable that ranges between zero and four, count data models are estimated. The most known models are the Poisson Regression Model (PRM) and the Negative Binomial Regression model (NBRM). Among the strategies used by the mobile users we have the following:

- i. Beeping. Action in which the person who makes the call hang up before it was answered.
- ii. SMS. The use of SMS is considered as a minimizing strategy since it reduces the cost and could be used everywhere.
- iii. Phone receiver. This is defined as the people who answered that have the phone in order to be available (receive calls) but they do not use it to make calls.
- iv. Off- peak calls. Some users try to communicate by mobile only when prices are the cheapest. During off peak hours, it is common to find lower prices than working hours.

For the estimation, all the variables mentioned before are equal to one if the person uses that strategy and zero if not. As a result, someone who uses all the strategies gets a score of four, someone who do not use any strategy gets a zero and so on. In each country of the sample people were asked about the use of the above strategies for minimizing their mobile spending.

### *A. Logit models*

In this part, we are interested in assessing the determinants of the use of each one of the strategies by the mobile owners. In each model, our dependent variable is equal to 1 if the respondent uses the strategy and zero otherwise. As explanatory variables, we include gender (*male* equal to one), a dummy variable for age (young is equal to one if the person is younger than 22 years old), overcrowding measured as the number of people per room as a proxy of socioeconomic status, a dummy that it is equal to one if the user has a mobile in the modality of prepayment (*Prepaid*), a Information and communication index (ICT) constructed taking into account levels of use of mobile and fixed telephony and internet use. Education is included in

two different ways: as a continuous variable and a categorical variable. In the last case, the variable 'Education' is equal to one if the user has at least secondary education. Both specifications give us similar results. In order to capture the effect of the intensity of use, we use the numbers of calls the user makes from a mobile phone, (*Intensity of Use*).

The most important finding is that the use of these strategies has common patterns among the selected country samples. Those strategies that require deep knowledge of technology as SMS are used more often by young people, users with a frequent use of technologies (ICT) and people with high education. Users in the modality of prepayment has a higher probability of use SMS. The utilization of Beeping is common among users in young people but the effect of other variables depends on the country. For example, in Mexico exist a gender effect meanwhile in Colombia is more frequently used in people who demands high levels of use. The strategy off-peak calls, -that ask the user if he/she make calls during off-peak hours-, is used more often in Argentina and Peru (young people and people with a lower level of use of ICT), but it is not the case of Colombia and Brasil where it is not common to find price differentials between off peak and peak hours. Another interesting finding is the fact that mobile is used for receiving calls in the case of Mexican and Colombian women. In brief, the use of these strategies is related to the knowledge of the mobile functions and their capability of use them.

Table 3. *Marginal effects for Logit Models*

	1. SMS				3. OFF-PEAK					
	Argentina	Brasil	Colombia	México	Perú	Argentina	Brasil	Colombia	México	Perú
Men	-0,013 (0,01)	0,071*** (0,02)	0,009 (0,03)	-0,022 (0,07)	-0,005 (0,05)	0,023 (0,03)	0,042 (0,04)	-0,032 (0,04)	0,006 (0,06)	0,140*** (0,05)
Young	0,043*** (0,01)	0,63* (0,04)	0,083*** (0,04)	0,577 (0,08)	-0,150*** (0,08)	0,066*** (0,03)	0,019 (0,06)	0,045 (0,07)	0,072 (0,09)	0,030 (0,09)
Overcrowding	0,016*** (0,01)	-0,004 (0,01)	-0,015 (0,01)	0,003 (0,02)	0,009 (0,02)	-0,003 (0,01)	0,000 (0,02)	0,029 (0,02)	0,029 (0,02)	-0,039*** (0,02)
Education	0,059*** (0,01)	0,029 (0,10)	-0,044*** (0,02)	0,134 (0,14)	-0,174*** (0,06)	0,022 (0,03)	-0,123 (0,11)	-0,043 (0,04)	0,148 (0,13)	-0,035 (0,06)
Prepaid	-0,007 (0,01)	0,078** (0,04)	0,294 (0,03)	0,235 (0,09)	0,20*** (0,12)	0,011 (0,03)	-0,061 (0,12)	0,036 (0,06)	0,069 (0,10)	0,092 (0,16)
ict	-0,003 (0,07)	0,044*** (0,02)	0,032*** (0,018)	0,174*** (0,05)	-0,004 (0,05)	-0,045*** (0,02)	0,039 (0,03)	-0,011 (0,03)	-0,185*** (0,06)	-0,073 (0,05)
Use Intensity	0,001 (0,00)	0,0017*** (0,00)	0,001*** (0,00)	0,001 (0,00)	0,003 (0,23)	0,000 (0,00)	0,002 (0,00)	0,002 (0,00)	0,004 (0,00)	-0,08*** (0,04)
N	849	416	492	262	396	849	416	492	262	396
ll	-169,54	-266,57	-319,71	-130,72	-227,58	-375,41	-246,15	-289,08	-133,52	-268,54

Standard Errors in parenthesis.

Continua...

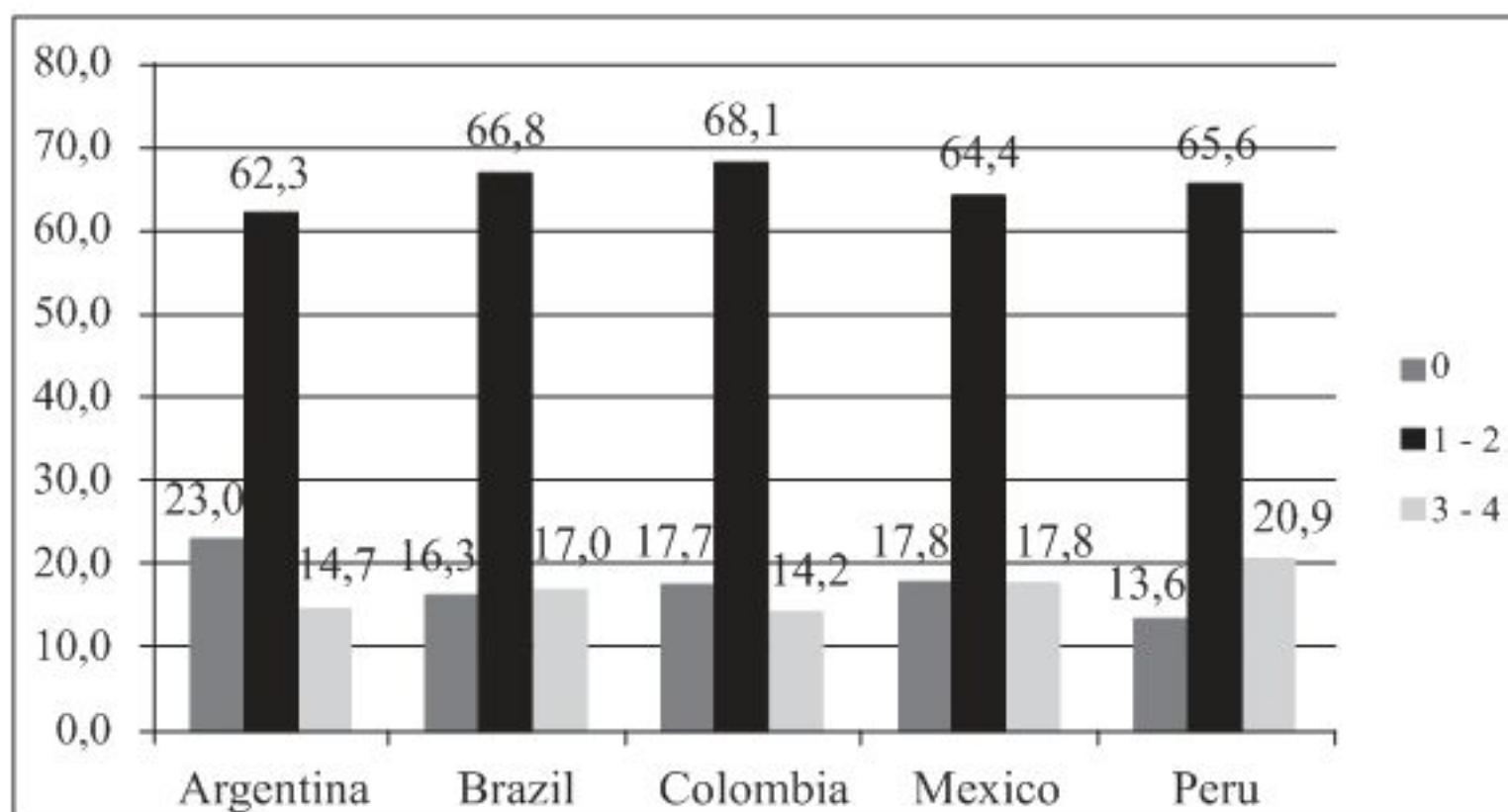
Table 3. Continuación

	2. ONLY FOR RECEPTION				4. BEEPING			
	Argentina	Brasil	Colombia	México	Perú	Argentina	Brasil	Colombia
Men	-0,014 (0,03)	-0,156*** (0,05)	-0,141*** (0,05)	0,052 (0,06)	-0,006 (0,03)	0,016 (0,020)	-0,05 (0,04)	-0,098*** (0,05)
Young	-0,002 (0,04)	0,023 (0,07)	0,043 (0,08)	-0,032 (0,09)	-0,019 (0,04)	0,056*** (0,27)	0,120*** (0,06)	0,212*** (0,07)
Overcrowding	0,011 (0,01)	0,031 (0,02)	-0,004 (0,03)	0,017 (0,03)	-0,014 (0,01)	0,020*** (0,01)	0,006 (0,02)	-0,056 (0,02)
Education	-0,018 (0,04)	0,202 (0,15)	-0,135*** (0,05)	-0,033 (0,11)	0,028 (0,04)	0,016 (0,02)	-0,247*** (0,08)	0,900*** (0,04)
Prepaid	0,115*** (0,04)	0,441*** (0,06)	0,298*** (0,08)	0,347*** (0,06)	0,145*** (0,03)	-0,045 (0,03)	0,040 (0,08)	0,146 (0,10)
ict	-0,010 (0,03)	0,025 (0,04)	-0,005 (0,04)	-0,073 (0,06)	0,021 (0,02)	-0,032* (0,01)	0,026 (0,03)	-0,006 (0,04)
Use Intensity	-0,004*** (0,00)	-0,011*** (0,00)	0,001 (0,00)	-0,003 (0,00)	-0,002 (0,00)	0,000 (0,00)	0,001 (0,00)	0,004** (0,00)
Phone Reception						0,197*** (0,03)	0,097*** (0,04)	0,116*** (0,08)
Beeping	0,341*** (0,04)	0,118*** (0,05)	0,116*** (0,04)	0,033 (0,05)	0,198*** (0,05)	-0,04 (0,05)	-0,05 (0,04)	-0,05 (0,04)
N	849	416	492	262	396	849	416	492
ll	-526,16	-263,64	-316,71	-156,27	-181,27	-356,59	-256,47	-321,71
							-135,08	-222,43

Standard Errors in parentheses

### B. Poisson Model

Due to the design of the survey let the people to answer more than one minimizing strategy, in this part we use a discrete specification that counts the number of strategies the person use. The distribution of the population on the strategies is highly similar across the countries. Most of the people use one or two strategies, but most interesting is the fact that less developed countries such as Peru and Colombia tend to use more frequently three or four strategies.



Source: DIRSI Survey

Figure 3. *Number of Strategies Used by Country (%)*.

Our second objective is to find what determines that any person uses more strategies. From the survey design, it is possible to generate the variable 'total strategies' defined as the number of strategies used by the person. As a result, the outcome of interest is a non-negative integer three ranging from zero to four. Because the response is discrete, its distribution only places probability mass at non negative integers. We have three alternatives, among the possible econometric models: Ordinary Least Squares, Count Data Models and Ordered Probit models. OLS is not a good choice because it assumes a continuous distribution. It is important to highlight that we can extract from the survey whether the person use or not any strategy but the intensity of use of each one it is not available. (See, for details, Cameron and Trivedi, 2005) The two other strategies remaining provide different coefficients and interpretations. Count data is a non linear model which

can be used for estimating semi-elasticities, meanwhile Ordered Probit gives us the probability of using 0,1,2,3 or 4 strategies.<sup>2</sup> In order to test the robustness, we estimate both, but only Poisson semi-elasticities are shown.

Among the set of count data models, we choose Poisson Regression Model over negative binomial for their goodness of fit. The regressors include the same set from the previous estimation.

Table 4 summarizes the results for the selected country-samples. It is important to note that due to data availability, this kind of regression cannot be done for representative samples in each country. We include two specifications for Brazil, Colombia and Mexico due to availability of the variable “per capita income”. For Argentina and Peru, we continue using overcrowding as a proxy of socioeconomic conditions.

Table 4. *Poisson regression model*

Semi-elasticities

Dependent Variable : Number of Strategies Used

	Argentina	Brazil	Colombia	Mexico	Perú			
Gender	-1,1 (-0,6)	-26,5*** (-13,1)	-27,9*** (-14,1)	-13,9*** (-6,8)	-15,0*** (7,5)	-5,9*** (-2,8)	-6,5*** (-3,1)	-0,1 (-0,1)
Young	11,3*** (4,9)	24,2*** (8,4)	20,2*** (7,0)	29,3 (8,4)	29,5*** (8,4)	-1,7*** (0,7)	-1,9*** (-0,7)	3,2*** (1,0)
Schooling	7,0*** (3,1)	-5,1*** (-0,8)	-3,1*** (0,5)	-6,8*** (-3,5)	-7,2*** (-3,6)	19,8*** (4,9)	17,4*** (4,4)	-8,7*** (-4,1)
Overcrowding	4,0 (4,6)	4,8 6,0		2,20 (2,0)		3,80 (5,0)		2,00 (2,5)
Prepaid	5,6*** (2,4)	127,7*** (19,8)	147,9*** (21,5)	32,2*** (9,0)	33,1*** (9,3)	249,7*** (60,1)	246,9*** (65,5)	296,2*** (69,1)
ICT	-2,7*** (1,5)	10,9 (7,1)	9,2 (6,0)	1,7 (1,1)	0,7 (0,4)	8,8 (5,5)	7,7 (4,8)	10,00 (6,2)
Capital city	3,1*** (1,4)	-20,5*** (-10,7)	-19,1** (-10,0)	36,8*** (14,7)	37,3*** (14,9)	-11,1** (-5,7)	-12,3*** (-6,2)	-10,1*** (-4,4)
Intensity of Use	-0,2	-0,4	-0,4	0,5	0,5	1,0	1,0	-0,3

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<sup>2</sup> There are other alternatives such as Multinomial Logit or Zero-inflated models. However, there are not adequate because it is clear that 4 categories is better than 3 and 2 categories and we no don have high incidence of zeros in the dependent variable.

	(-2,6)	(-4,9)	(-5,1)	(8,9)	(8,9)	(7,9)	(7,9)	(-2,1)
Per capita income			-0,0		0,0		-0,0	
			(-8,3)		(1,6)		(-0,5)	
N	849	416	416	492	492	262	262	396
L1	-1073,85	-596,81	-534,13	-739,71	-670,44	-336,09	-334,28	-595,46

Semi-elasticities are obtained by  $(\exp(BX)-1)*100$ . % Std Dev. in parenthesis.

Source: DHS - Macro International. 2005.

As it can be seen, there seems to be no gender difference in the number of strategies used in Argentina and Peru. In the rest of the countries the semi-elasticities are very different. The variable 'overcrowding' is not significant in the sample. This finding could be a consequence of the sample is focused in people from the BoP. It is also found that users in the modality of prepayment use more strategies than people with a contract with the operator. But the size of the coefficient is different in this country-samples, which could be a reflect of the competition between prepaid and post paid modalities. Young people tend to use more strategies but in Mexico and Peru this relationship is in the opposite way. We also include two variables of digital literacy: Schooling and ICT. Our findings are not definitive in this aspect because of the sign of the coefficients and their construction. It is important to say that literacy is very different between countries as Argentina and Mexico and it generates different results. Our variable "Capital city", which is equal to one if the person lives in the capital of the country, is significant in several cases. However, its sign is different as a consequence of the importance of mobile into the set of communication alternatives in these countries. In Mexico and Brazil, there are no many local operators competing in the markets.

### Concluding remarks

The use of strategies for minimizing the cost of mobile use is common among people from the BoP in these selected countries, where most of the users have their mobile in the modality of prepayment. The higher level of incidence of strategies mentioned is more often when the cost of a call is higher. There are considerable differences among the cost of each one of the alternatives for communication but there is not availability of

information for each plan for estimating cross elasticities. In the particular case of Colombia, higher price differentials between fixed to mobile and off-net vs. on-net calls could incentive the shared use of mobile in countries as in the case of Colombia. Due to these factors, the use of the mobile for receiving calls is the most often strategy employed in almost all the selected countries (Brazil, Colombia, Mexico and Peru).

It is also important to note the complementarity between strategies such as the use of phone for receiving calls and the use of beeping, because it is expected that people who uses intensively one of these strategies also tend to use the other. This is an interesting finding that could explain that this population segment tends to restrict the use of mobile.

In the other side, we can find the case of Argentina, where SMS has a high demand. As Ramirez and De Angoitia (2008) show, poor people in Latin American countries utilize different strategies as their similar of Asia and Africa. In our results, we can state that the literacy explain the choice of strategy used.

From the DIRSI experience, it is important to note that the surveyed do not make a correct cost-benefit analysis in their mobile spending due to the existence of barriers to credit markets and the high size of informal economies that affect the stability of the income perceived (for details, see [www.dirsi.net](http://www.dirsi.net)). In many cases, the cost per minute is higher or equal to other alternatives that they cannot afford. However, high penetration levels in this segment of the population let the government to use mobile for accessing population. Social security, education and labor programs could use mobile for sending information and it will received in low and high income households.

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